
QC/AA Proof Of Concept Demonstration Overview

QUALCOMM and American Airlines Collaboration



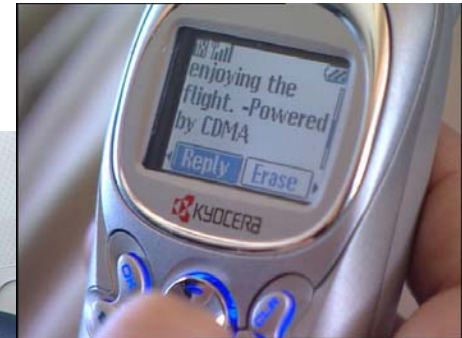
- **World's largest carrier**
- **Desire, expertise and network to provide its customers products and services to ensure the best in-flight experience**



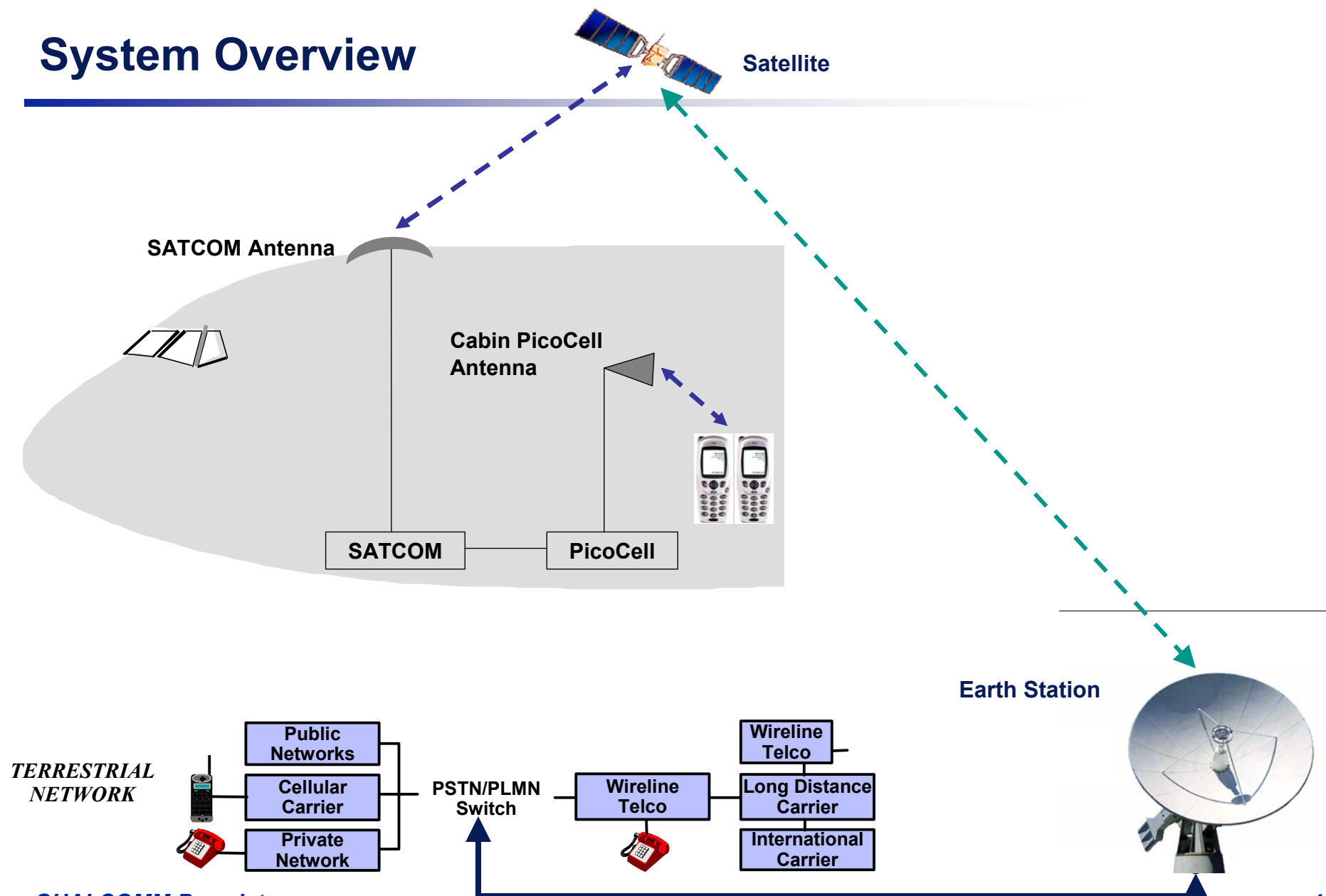
- **Innovator of Digital Wireless Communications, both Satellite and Terrestrial**
- **Pioneer and Developer of CDMA, the worldwide choice for Third Generation Cellular Networks**

Proof-of-Concept Demo

- Enable passengers to experience the use of a standard carry-on mobile phone in a commercial aircraft environment:
 - Place voice calls to any destination
 - Receive voice calls dialed to your personal cell phone number from any location
 - Two-way short messaging (SMS)
- Share the research that has been conducted in support of aircraft safety evaluation and commercial realization of such a service

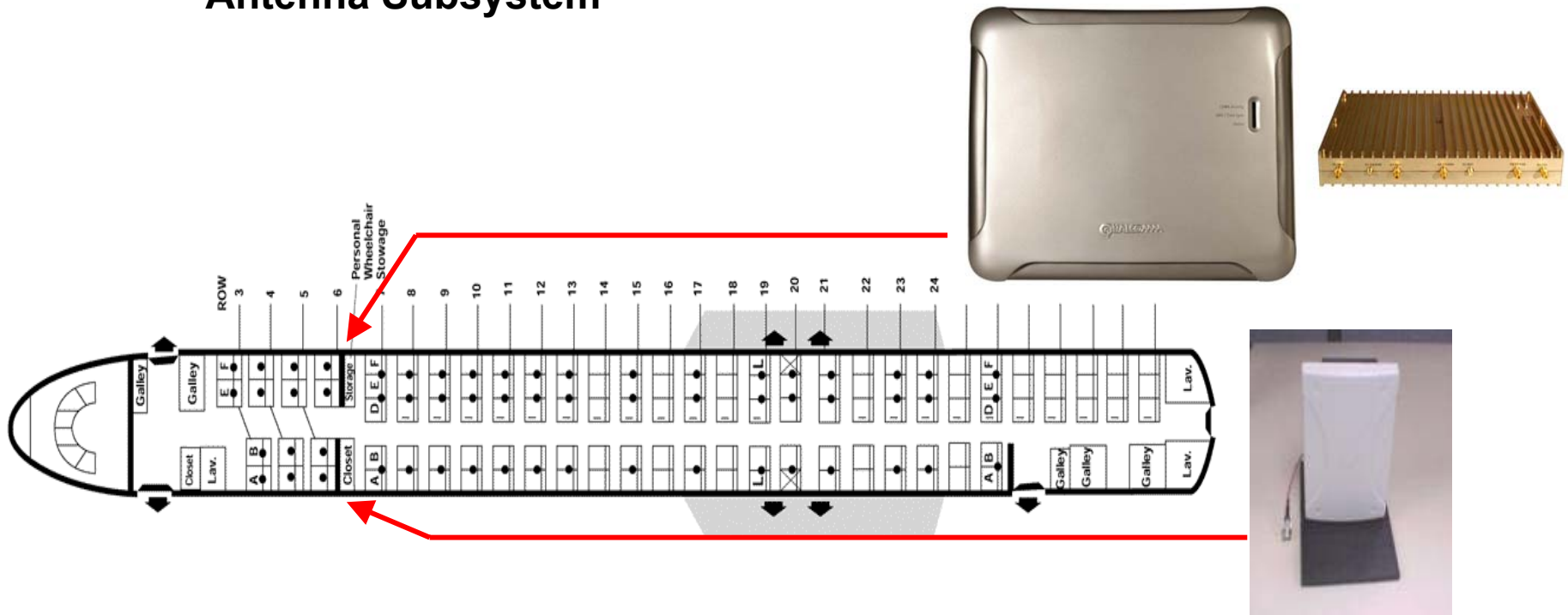


System Overview



“Picocell” Cabin Network

- Three components associated with the “picocell” cabin network
 - Base station Transceiver Subsystem (BTS)
 - Base Station Controller (BSC)
 - Antenna Subsystem



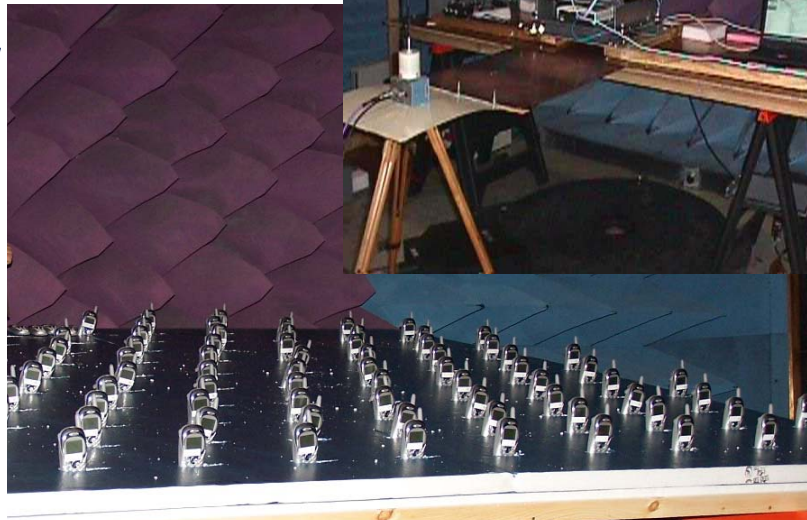
Aircraft to Ground Link - Globalstar

- “Picocell” system integrated with GlobalStar Packet Data Airborne terminal (MDSS)
- Allows us to demonstrate multiple simultaneous calls
- Installed and FAA certified (STC) on the AA MD Super 80 aircraft
- Unique low profile antenna is compatible with the MD 80 aircraft



Aircraft Safety Verification

- QUALCOMM has completed a number of test programs in the laboratory and on board private and commercial aircraft
- Extensive ground and flight EMI tests performed to support today's demonstration
- Maximum testing configurations:
 - 50-100 phones
 - Maximum power
- No anomalies have been observed in the avionics



Pico Cell Network Testing



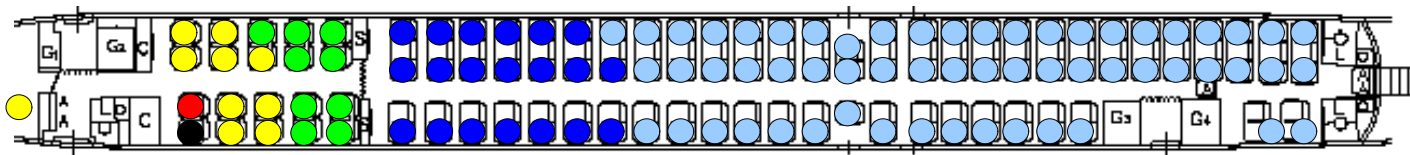
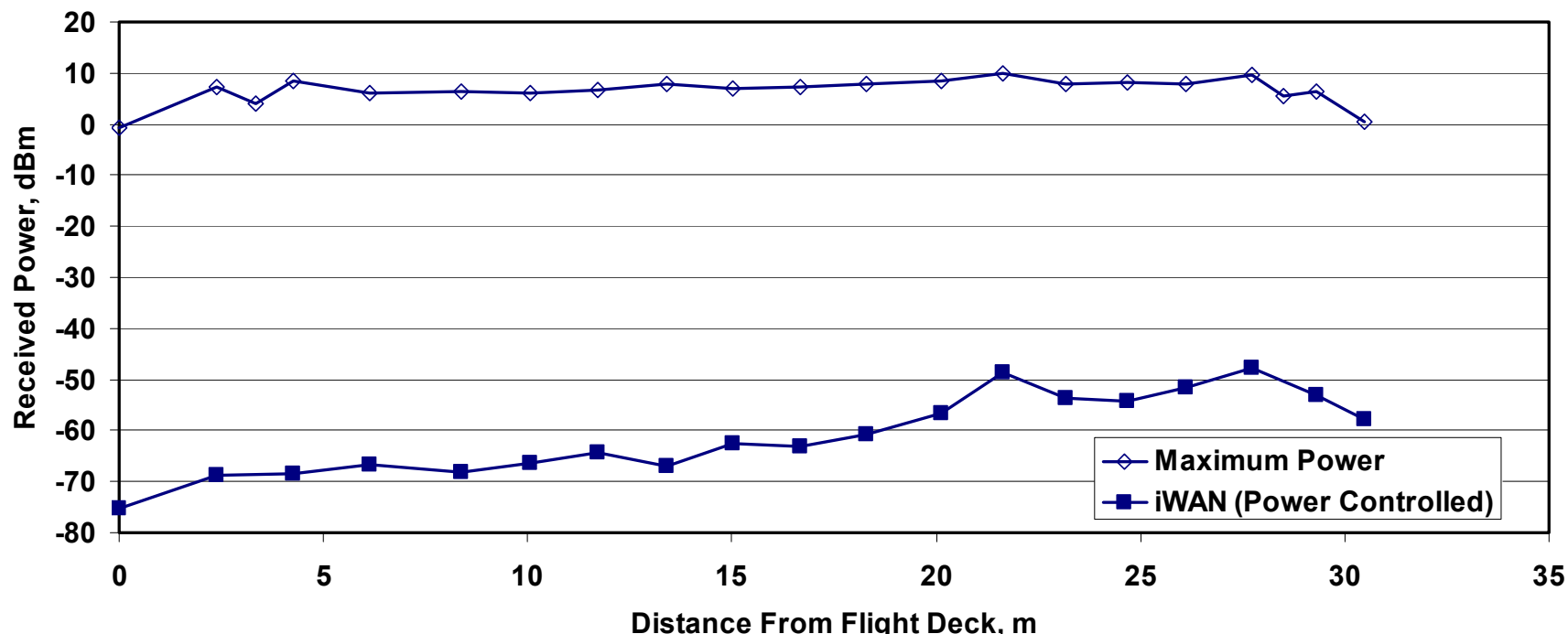
iWAN BTS (3 sector)



Cabin Antenna

- Measurements of phone power under “Pico” BTS control
- Leakage from Pico BTS and Phones to ground networks

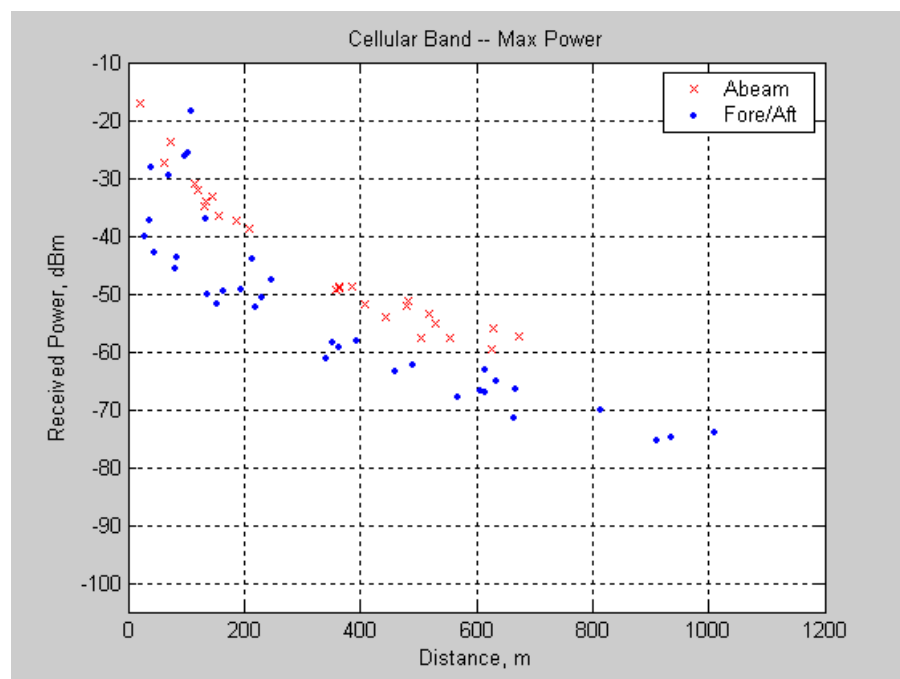
Effect of Power Control



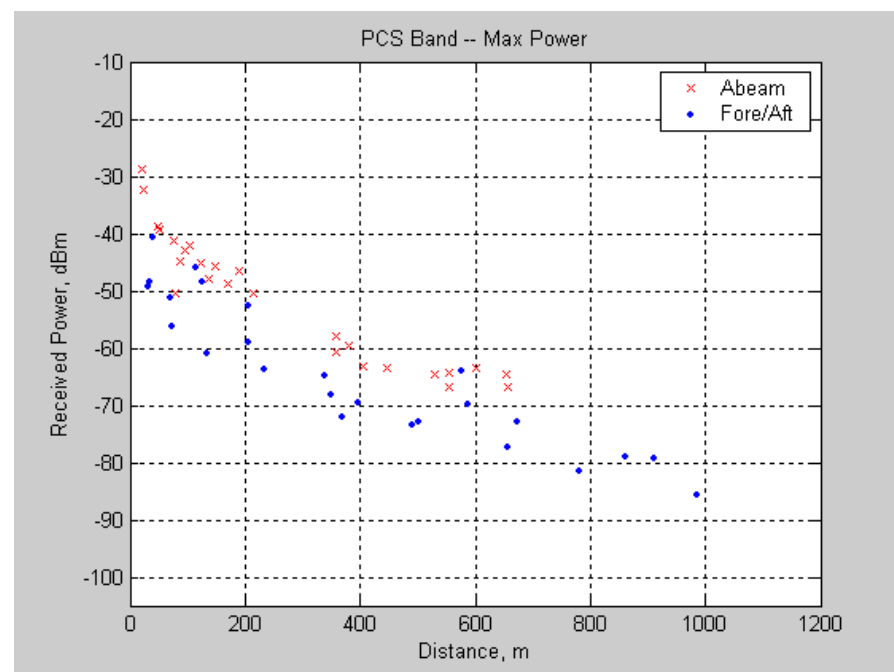
- Phones power controlled by Picocell transmit 50-70 dB less power than maximum

External Signal Leakage Reverse Link – Full Power

Cellular Band



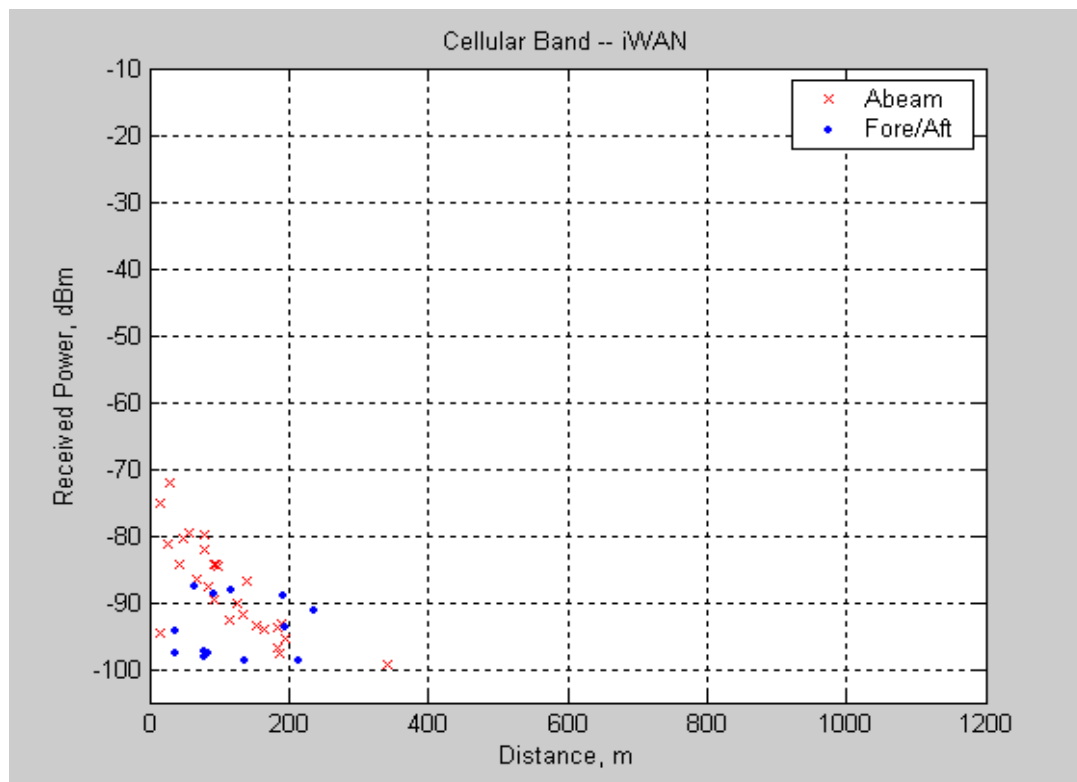
PCS Band



- **Accumulated power from 100 phones operating at maximum output was still detectable at a range of 1.0 km for both frequency bands**

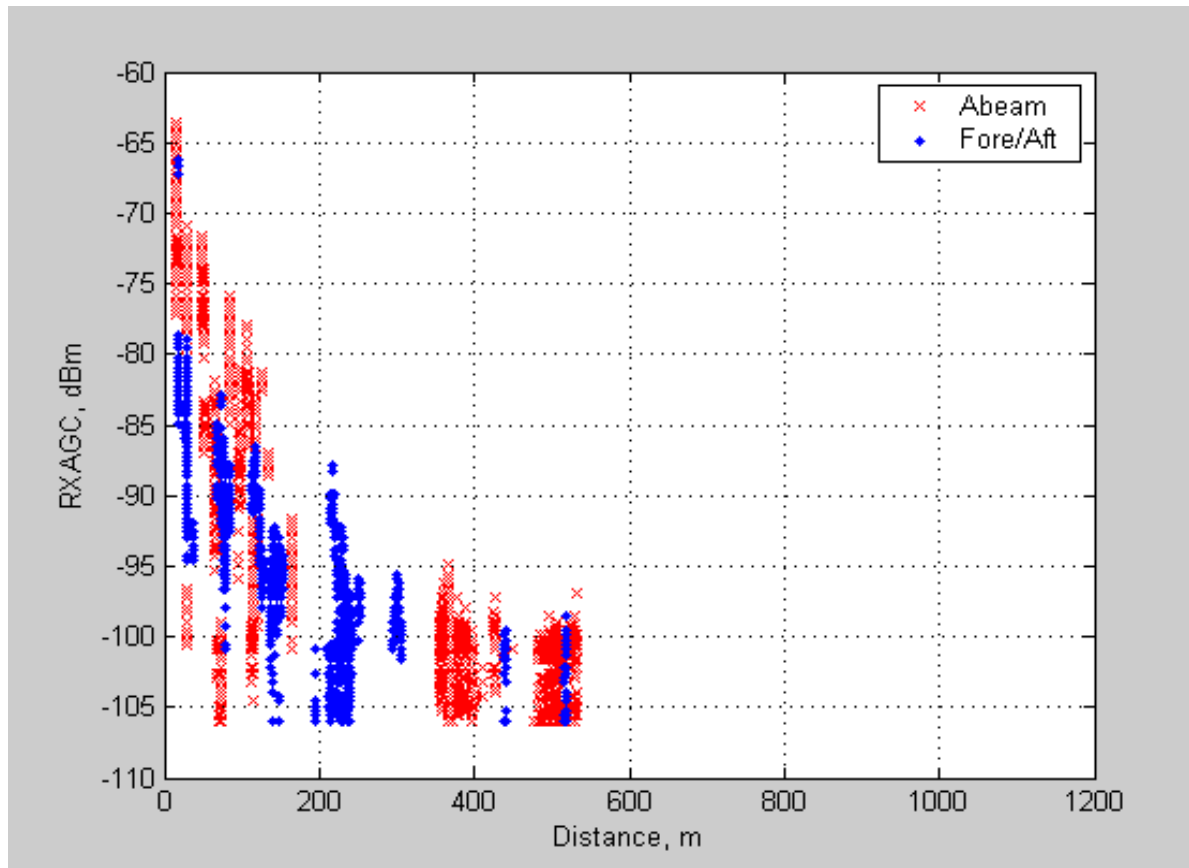
External Signal Leakage

Reverse Link – Power Controlled



- Little signal power was observable beyond approximately 200 m from 100 phones transmitting at power levels controlled by a Picocell.
- Received powers were 50-60 dB lower than full-power case

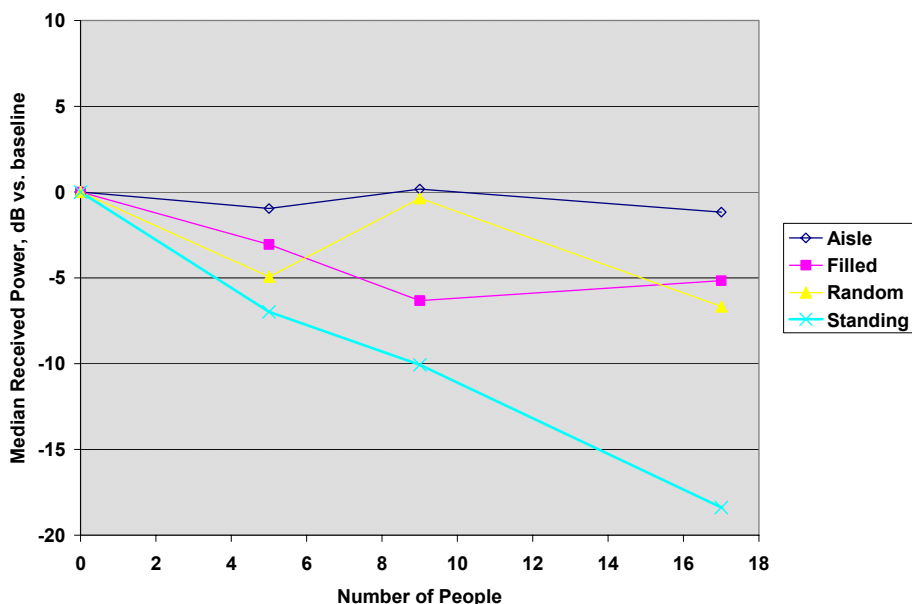
External Signal Leakage Forward Link



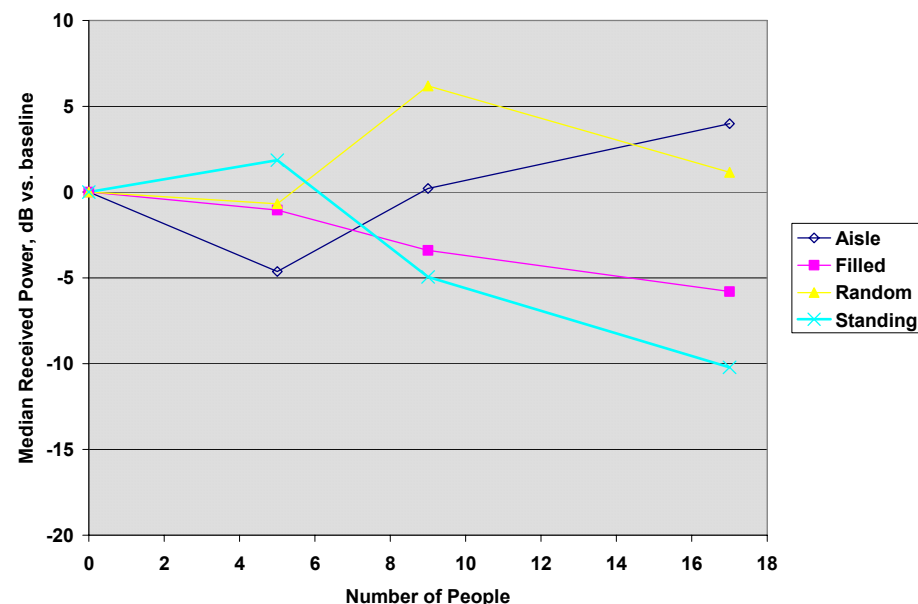
- **Beyond a distance of 550 m, the phone was unable to detect the Picocell's forward link**

Passenger Effects

Cellular Band



PCS Band



- Only standing passengers had a discernable effect: 0.5 – 1.0 dB per person

Authorizations Required for “Picocell” Testing

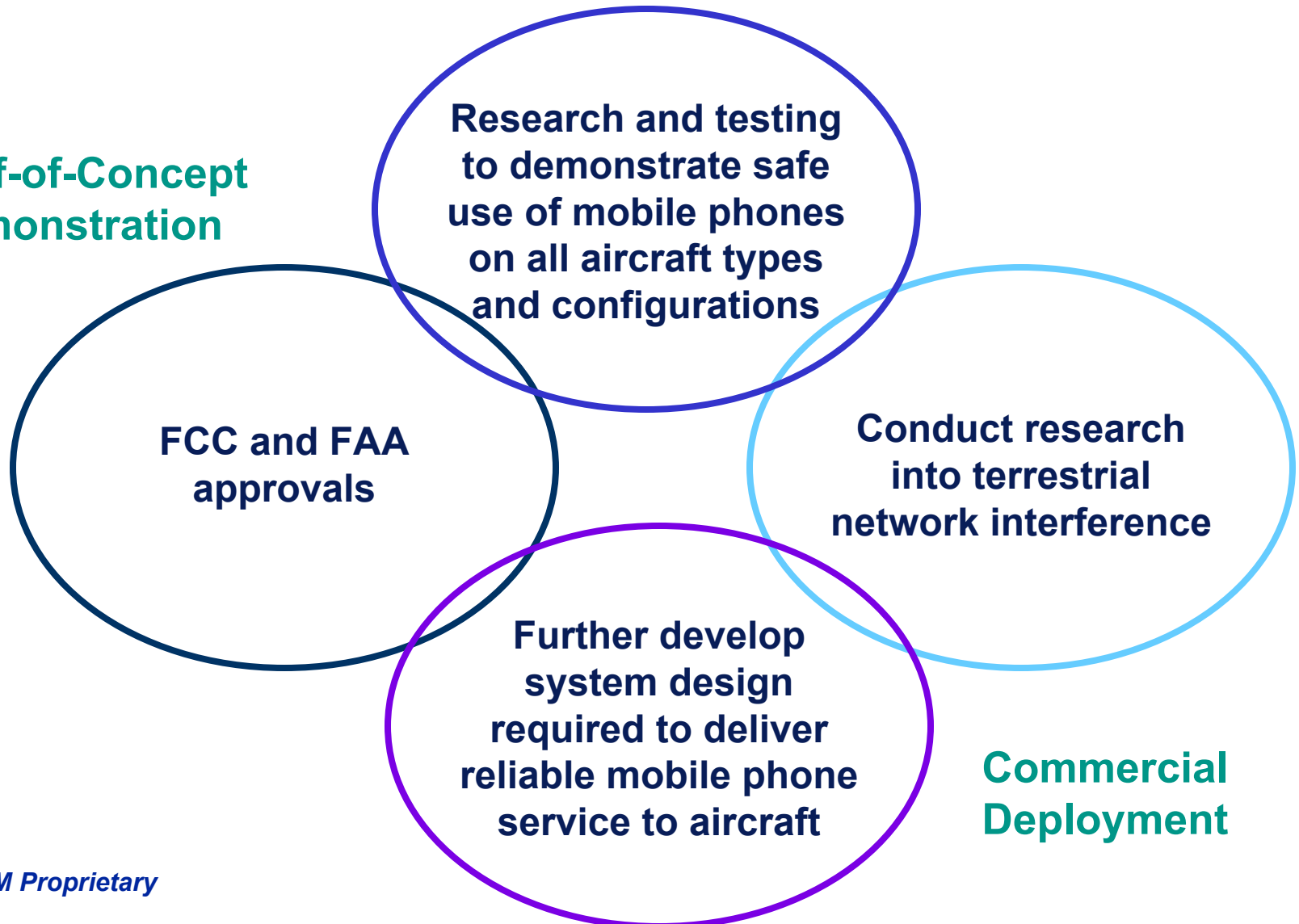
- **Obtained experimental license from the FCC in support of ground and airborne testing and demonstration**
- **Received full support and cooperation from CDMA wireless service providers**
- **Connected into Sprint PCS network for this demonstration**
- **Utilized GlobalStar satellite service through its commercial gateway (Clifton, TX)**

Demo Statistics

- **60 passengers (40 media and 20 VIP's)**
- **2 Hour Flight (Dallas Fort Worth to Lubbock Loop)**
- **Use of Passenger's own phones with Sprint service**
- **Limited to 12 Simultaneous calls "off" aircraft**
- **Unlimited calls within the cabin**
- **Unlimited SMS calls "off" the aircraft**
- **332 Total Calls made during flight**
- **Media Coverage Overview:**
 - **Print hits: 27**
 - **Broadcast (TV & Radio): 110**
 - **Online hits: 330**

Next Steps

**Proof-of-Concept
Demonstration**



**Commercial
Deployment**